Estimation of Ocean Surface Wind Speed and Direction from Polarimetric Radiometry Data

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LONG-TERM GOALS

To measure vector wind fields over the global oceans on a continuous basis using satellite-borne microwave radiometers.

OBJECTIVES

To develop accurate and efficient methods for estimating the surface wind speed and direction from polarimetric radiometry data.

APPROACH

The approach taken in this project is to formulate algebraic solutions for the quantities of interest, based on analytical models which have been developed using numerical simulations (Lyzenga, 2006) as well as analyses of data collected by the WindSat polarimetric radiometer (Gaiser *et al*., 2004).

WORK COMPLETED

A set of algorithms has been developed and tested using a relatively small subset of WindSat data. Comparisons have been made between the wind directions inferred from polarimetric data collected from a single look direction as well from two look directions (fore and aft scans).

RESULTS

Preliminary results indicate that better wind direction estimates are obtainable by using measurements of the third Stokes parameter from two look directions, as opposed to using measurements of the third and fourth Stokes parameters from a single look direction. For wind speeds greater than 8 m/s, the rms error in the wind direction was estimated to be 11.3 degrees using two look directions, and 33 degrees using a single look direction (Kim and Lyzenga, 2008). This suggests that a system capable of measuring the third Stokes parameter over the full conical scan angle may be more valuable than a fully polarimetric system with a partial scan angle range. However, these results need to be confirmed using a much larger WindSat data set.

IMPACT/APPLICATIONS

The results of this investigation are expected to be relevant to the design of future satellite radiometers as well as the processing of data from these radiometers.

REFERENCES

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PUBLICATIONS

Duk-jin Kim and D.R. Lyzenga, "Efficient model-based estimation of atmospheric transmittance and ocean wind vectors from WindSat data," *IEEE Trans. Geosci. and Remote Sens.*, vol. 46, no. 8, pp. 2288-2297, 2008.